IMAGING SYSTEM WITH MEDIA CARRIER STORAGE POSITION

Reference to Related Application

[0001] This application claims the benefit of the filing date of Application No. 60/412,569 filed on 23 September 2002.

Technical Field

[0002] The invention relates to the field of imaging printing precursor elements for use in printing operations.

Background

[0003] Digital imaging systems have now gained wide acceptance in the preparation of printing precursor elements for use in printing operations. For example, flexographic printing presses are widely used in the printing of packaging products where the use of a compressible relief imaging element is advantageous for printing on a variety of substrates including, for example, plastic and cardboard. A flexographic media generally comprises a layer of photopolymer that is exposed to UV radiation through an image mask, such as a film, to selectively harden the photopolymer.

[0004] In recent years digital flexographic media has become available with an integral image mask layer that is imaged in a digital imaging system using an imagewise-controllable laser source. The media is typically made available in flat plate sections that are adhered to a cylindrical flexographic printing form after the relief image has been formed and processed. Interest is growing in providing continuous flexographic elements that have no discernable seam joints around the periphery of the cylinder. Seamless flexographic printing elements are particularly useful in printing continuous repeat patterns such as wallpaper and wrapping paper.

[0005] The handling of both flat and seamless flexographic media presents a problem. Imaging devices, which use flat media have a cylindrical drum around which the flat media is wrapped. Imaging devices which use seamless media have a mandrel over which a sleeve can be loaded. Additionally flexographic printing forms are often used in VLF (Very Large Format) sizes such as the ThermoFlex™ 5280 sold by Creo Inc of Burnaby, British Columbia, Canada, which is able to load flat media sized up to 52 inch by 80 inches. The large size of VLF media along with the industry demand to handle seamless sleeve formats presents a challenge for media handling.

[0006] The problem is not confined to the flexographic printing field. The handling of multiple formats of imaging media in lithographic platemaking, gravure, proofing, and other imaging areas also has the same problem that different media require different apparatus for imaging. There remains a need for better methods and apparatus for accommodating a variety of different sizes and formats of media in imaging devices.

Summary of Invention

[0007] A first aspect of the present invention provides an imaging apparatus with at least one media carrier and an imaging position for locating the media carrier such that an imaging media supported thereon is proximate to an imaging head. The apparatus has a storage position for storing at least one unused media carrier and a transport mechanism for moving the unused media carrier between the storage position and the imaging position.

[0008] Another aspect of the invention provides a method of imaging a media. An image is formed on a first media mounted on a first media carrier located in an imaging position and then the media carrier is

transported to a storage position located proximate to the imaging position. A second media carrier is loaded in the imaging position an image is formed on a second media mounted on the second media carrier.

Brief Description of Drawings

[0009] In drawings which illustrate by way of example only preferred embodiments of the invention:

Figure 1 is a perspective view of an imaging engine having a cylindrical drum in an imaging position;

Figure 2 is a perspective view of an imaging engine having a cylindrical drum in a storage position;

Figure 3 is a perspective view of an imaging engine having a sleeve and sleeve mandrel in an imaging position with a cylindrical drum in a storage position;

Figure 4 is a perspective view of an imaging engine showing an alternative method of loading or unloading a sleeve without removing the sleeve mandrel;

Figure 5 is a perspective view of an imaging engine with the drum removed to show the drum transport mechanisms; and,

Figure 6 is a flowchart depicting one embodiment of a method of the invention.

Description

[0010] Throughout the following description, specific details are set forth in order to provide a more thorough understanding of the invention. However, the invention may be practiced without these particulars. In other instances well known elements have not been shown or described in detail to avoid unnecessarily obscuring the invention. Accordingly, the specification and the drawings are to be regarded in an illustrative rather than a restrictive sense.

[0011] The invention is described in relation to an imaging system that accommodates one or more media carriers for mounting imaging media. The media carrier may be a sleeve mandrel for mounting a cylindrical sleeve media or a drum for mounting flat sheets of media and/or various combinations thereof. The system provides storage facilities, which may be integrated into the body of the device, for a drum or sleeve mandrel that is not being imaged, thus reducing or eliminating the need to provide separate safe storage for the media carrier when not in use.

[0012] Additionally the system may also allow media to be loaded onto a drum or mandrel when the drum or mandrel is in a storage position while another sheet or sleeve is being imaged on a different drum or mandrel. Drums and mandrels are examples of media carriers.

[0013] In an embodiment of the invention shown in **Figure 1** to **Figure 4**, an imaging engine **8** has a frame **10** supporting a fixed headstock **12** and a moveable tailstock **14**. A rotatable cylindrical drum **16** is shown supported between headstock **12** and tailstock **14**. Headstock **12** is driven via a belt and pulley **18** by a motor **20**. An imaging head **22** located on a linear track **24** is disposed to form an image on media **28** held on drum **16**. The media **28** is scanned by a combination of the rotation of drum **16** and linear translation of exposure head **22** along track **24**. Drum **16** is generally provided with some means for clamping a flat sheet of media **28**. The clamping force may be provided by a vacuum applied via a series of holes and/or grooves in the surface **26** of drum **16** or may be provided by magnetic, spring clamps or any other suitable mechanical clamping means.

[0014] In general, it is necessary for drum **16** to be kept in precision alignment with tracks **24** as dictated by the design and configuration of the exposure head **22**. In order to meet these precision requirements the attachment and alignment of drum **16** to headstock **12** and tailstock **14** employs components that may be susceptible to damage or contamination. Furthermore, should the surface **26** of drum **16** be damaged or debris be accumulated thereon, the imaging performance may be compromised by bumps or dents in the drum surface **26** that may transmit to the loaded media **28**.

[0015] Once imaging is completed, drum **16** may be disengaged and moved into a storage position within the confines of the frame **10,** or elsewhere within the enclosure of the imaging device. In **Figure 2** the drum **16** is shown in a storage position. The imaged media **28** may be removed from drum **16** either while drum **16** is in the imaging position or while the drum is in in the storage position. Referring now to **Figure 3**, once drum **16** is in its storage position, a sleeve on a mandrel **30** or on another drum (not shown) may be loaded into the imaging position.

[0016] Mandrel **30** may be a two-part assembly comprising a universal arbor **32** with a shell **34** fitted over the arbour. Several shells of different diameters may be provided to accommodate a variety of different sleeves **36**. Alternatively, as shown in **Figure 4**, arbor **32** may be loaded first (with or without shell **34**) and then sleeve **36** loaded over the shell **34**. The sleeve **36** may be a thin-walled metal or composite cylindrical tube with the media applied to the outer surface. The outside diameter of shell **34** may be chosen to be slightly larger than the inside diameter of sleeve **36**. Shell **34** may be provided with a number of air holes in its surface through which air can be forced. This permits sleeve **36** to be floated on a cushion of air onto the shell **34**, the air expanding sleeve **36** to enable easy location. When the supply of forced air is

discontinued, sleeve **36** contracts to form an interference fit with shell **34**. In the embodiment shown in **Figure 4,** arbor **32** is held in a cantilevered fashion by headstock **12,** with tailstock **14** rotated out of the way as shown. This allows sleeve **36** to be loaded onto shell **34.**

[0017] While in **Figure 3** and **Figure 4** mandrel **30** is shown as a two part structure comprising an arbor **32** and a shell **34,** is should be appreciated that a mandrel may also be a single structure without a replaceable shell **34,** albeit at potentially increased cost.

[0018] In an alternative embodiment, the media may be loaded onto the drum or a mandrel by manual or automated means while the drum or mandrel is in its storage position. By re-locating or duplicating the loading functions from the imaging position to the storage position, loading is decoupled from the imaging operation. This allows imaging and loading to proceed in parallel, thus increasing the throughput of the machine. The media carrier may also be a cylindrical printing element precursor where the image is formed on the coated or uncoated surface of the cylinder and the entire cylinder is moved to a printing press for use in a subsequent printing operation.

[0019] Apparatus according to the invention includes a transport mechanism capable of moving a drum from an imaging position to a storage position or vice versa. The transport mechanism is subject to a number of design considerations. Firstly, the time taken to enact a change between drum and mandrel should be commensurate with the overall productivity of the machine. Accordingly the engagement and disengagement of the headstock, tailstock and transport hardware should be arranged to meet repeatability and precision requirements without the need for unduly time consuming adjustments. At the same time, it is desirable to avoid the need for any manual motion of the drum.

Requiring an operator to manually move a drum or mandrel is potentially dangerous since there is the potential for operator injury and/or damage to sensitive components.

[0020] **Figures 5-A** to **5-C** show one possible embodiment for a transport mechanism. An engine frame **10** is shown with a headstock **12** and tailstock **14**. In this particular embodiment, the drum is held in a pair of cradles **50** and **52**. The drum is not shown to enable a clear view of the transport components but the drawing figure should be understood to have a drum located in the cradles **50** and **52** in normal use. Each cradle is equipped with a plurality of compliant rollers **54** that engage the drum surface without risk of damage. In **Figure 5-B**, a lower portion of drum 16 is shown in cross section, resting on rollers **54**. Rollers **54** may be, for example, a plurality of compliant rubber rollers or a single elongated rubber roller. Advantageously, if rollers **54** are rotatable, drum **16** may be rotated in the cradle for purposes of alignment during the unclamping at the headstock. The spacing between opposing rollers **54** may also be made adjustable in a direction shown by arrow **55** to allow accommodation of a larger variation in media carrier diameters. While in this embodiment the holder that engages the drum is shown as a cradle that contacts the underside of the drum or mandrel, this is not mandated. Any means of supporting the drum including, but not limited to any axial support means, is considered within the scope of the invention.

[0021] Returning now to **Figure 5-A** cradles **50** and **52** are located on support rails **56**, which support the cradles and allow movement in the direction laterally away from or towards the headstock. The movement disengages the drum from headstock **12** once the tailstock **14** has been disengaged and is activated by a lever **58** which is pivotally attached to cradle **50** and fixed support **60**. A lateral movement of lever **58** is translated to the drum via cradle **50**. Cradle **52** may be rigidly linked to

cradle **50** so that the lateral movement of cradle **50** is translated to cradle **52** or alternatively, the weight of the drum **10** may be used to transfer the motion to cradle **52** with a spring bias to return cradle **52** to a home position when the drum is disengaged.

[0022] Referring now to **Figure 5-C**, cradles **50** and **52** have been moved vertically downward to the storage position in frame **10**. Again, the drum is not shown to enable a clear view of the transport mechanism. The vertical motion is provided by a second set of tracks **62** and a leadscrew **64** located at both the headstock side and tailstock side of tracks **56** (the second set of tracks for vertical motion is not visible in the view as shown). Leadscrew **64** is rotated by a drive mechanism **66** that may comprise, for example, an electric motor or a manual hand crank. Typically, since the drum is typically very heavy, drive mechanism**66** will drive both the headstock and the tailstock leadscrews **64** simultaneously via a belt or other means.

[0023] It should be understood that while the embodiment shown transports the drum along a substantially vertical path from the imaging to the storage position, the path may also be horizontal, slanted or even curved depending on the configuration of the frame. Additionally, while the transport mechanism is shown using tracks and a leadscrew there are many ways of accomplishing the same result. Other examples of transport mechanisms capable of moving a media carrier between imaging and storage positions are known to those skilled in the art and include various existing mechanisms such as mechanisms actuated by linear motors, hydraulic or pneumatic actuators, and so on.

[0024] A method of operation of the transport mechanism is shown in the flowchart of **Figure 6**. Starting with the drum in an imaging position in step **70**, the cradles are brought up to engage the underside of

the drum in step **72** thus supporting the drum prior to disengagement. In step **74**, the drum axis is unclamped at the headstock. The unclamping may comprise releasing a set of cam bolts or other clamping means known in the art. In step **76**, the tailstock is unclamped and axially disengaged from the drum. The tailstock may then be rotated out of the way.

[0025] The drum is then moved axially away from the headstock along a path defined by the transport hardware in step **78**, thus freeing the drum from the headstock. In step **80**, the drum may then be lowered in the cradle to the storage position. In step **82**, the drum is secured in the storage position.

[0026] The example in **Figure 6,** while specifically pertaining to the lowering of a drum to a storage position, may be reversed in order of steps to take a drum from a storage position to an imaging position. Likewise, the handling of sleeve mandrels is similarly accomplished. Furthermore, while in the embodiment described manual exchange of the drum assisted by transport hardware is contemplated but it should be easily appreciated by a person skilled in the art that some or all of the operations may be automatically performed without departing from the scope of the invention. It should be further understood that the embodiment of the method described may include additional steps to ensure safe handling of the drum or mandrel.

[0027] In an extension of the concept outlined in the aforegoing description, the storage may be extended to incorporate storage for a plurality of drums and/or sleeve mandrels simultaneously. Many such designs of a multi-storage device are possible with the potential to move a drum or mandrel into a load position from a storage position, load the

media or sleeve thereon, and then move the drum or mandrel into an imaging position on completion of the previous image.

[0028] A wide range of media imaging systems may benefit from the methods and apparatus described herein including, but not limited to flexographic, lithographic, gravure, film and proofing media in either flat or sleeve format. Similarly the present invention may be beneficially applied in any case where combinations of different imaging media having different format, size or mounting requirements are to be imaged in a single imaging device. In many cases, the major difference between imagers for specific different media types is to be found in the media carrier where size, support and securing features are customized for the specific media. The imaging head may employ any of a variety of imaging processes known in the art and may be a controllable radiation source that effects some change in the media or removes material from the media. Alternatively, the imaging head may deposit material in response to image data, as would be the case if a mask material or other substance were to be inkjetted onto the media surface.

[0029] As will be apparent to those skilled in the art, in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof.